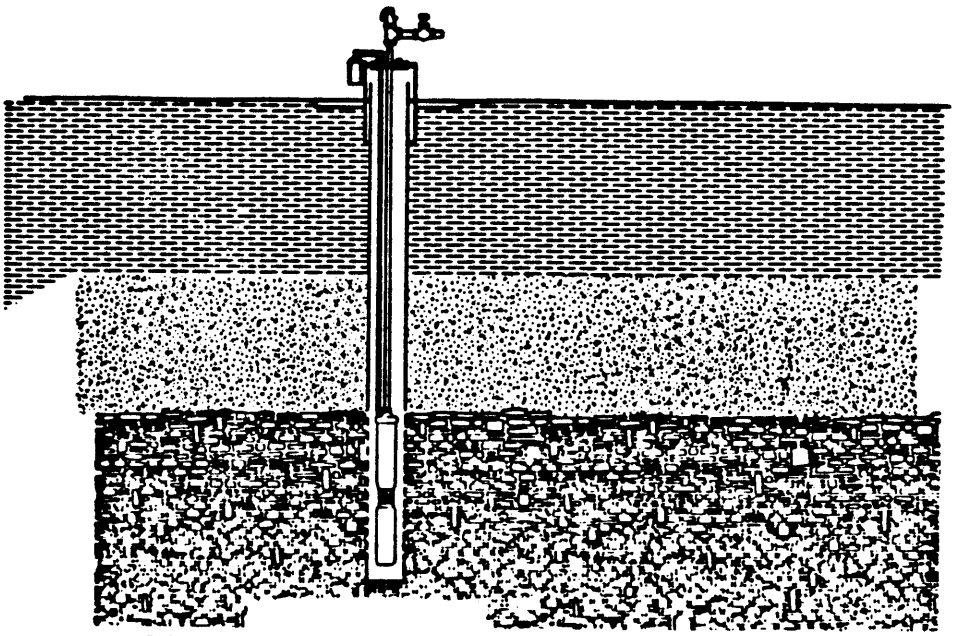
US Army Corps
of Engineers
Tulsa District

TINKER AIR FORCE BASE

OKLAHOMA CITY, OKLAHOMA

SAMPLING AND ANALYSIS PLAN



Sampling and Analysis Plan Revision 1

Doc #: 031588119 Cat: 3.2

REVISION 1 - MARCH, 1988

TINKER AIR FORCE BASE
INSTALLATION RESTORATION PROGRAM

GROUNDWATER AND SOIL SAMPLING AND ANALYSIS PLAN

FOR
CORPS OF ENGINEERS
SITE INVESTIGATIONS

REVISION 1 - MARCH 1988

Table of Contents

GROUNDWATER AND SOIL SAMPLING AND ANALYSIS PLAN
TINKER AIR FORCE BASE, OKLAHOMA
TULSA DISTRICT, CORPS OF ENGINEERS

I. Introduction.

A. Purpose and Scope. This sampling and analysis plan presents the methodology for collection, preparation, shipment, testing, and quality control for groundwater and soil samples taken at Tinker Air Force Base by Tulsa District sampling personnel. The purpose of the groundwater sampling program is to determine the presence, extent, and rate of movement of any contaminant plumes and the quality of the groundwater upgradient and downgradient of Tinker. The purpose of the soil sampling program is to determine the degree and extent of soil contamination around the sites, if any.

B. References. The following references were used in the preparation of this plan:

1. American Public Health Association and American Waterworks Association, *Standard Methods for the Examination of Water and Wastewater,* 16th ed., 1985.

2. U. S. Environmental Protection Agency, *RCRA Ground-Water Monitoring Technical Enforcement Guidance Document,* draft, August, 1985.

3. U. S. Environmental Protection Agency, *Test Methods for Evaluating Solid Waste,* SW 846, July, 1982.

4. U. S. Environmental Protection Agency, *Methods for Chemical Analysis of Water and Wastes,* EPA-600/4-79-020, 1979.

5. U. S. Environmental Protection Agency, *Handbook for Sampling and Sample Preservation of Water and Wastewater,* EPA-600/4-82-029, 1982

6. U. S. Environmental Protection Agency, *1980 EPA Methods,* EPA-600/4-80-032, 1980.

II. Field Procedures and Quality Assurance /Quality Control.

A. Monitoring Well Installation.

1. Drilling. All tools required for drilling are decontaminated following the procedures given in section D-2.

2. Setting Pipe. All piping and screens used in monitoring well construction remain in the factory sealed containers until use. These materials are never allowed to touch the ground during assembly. If this occurs by accident, the affected sections are cleaned with drinking quality water before use.

3. Placing filter sand and seal. Each batch of filter sand is sampled and analyzed for contamination. The sand is stored and transported in such a manner to prevent contamination. Bentonite is poured directly from the container to the well, or placed with decontaminated equipment. The seal is allowed sufficient time to expand and set before the well is grouted. If the seal is below the water table, no special procedures are required. If the seal is above the water table, drinking quality water is poured into the well to hydrate the bentonite.

4. Developing the Well. All equipment used in well development is decontaminated as described in section D-2. Well evacuation is accomplished with as large of diameter bailer as possible or with a surge block. When a bailer is used, it is raised and lowered quickly to agitate the water in and out of the screen and sand filter. Sediments are removed by bailing as much as possible, then pumping until the water comes out clear.

B. Groundwater Sample Collection.

1. Static water levels. Before any other work is done at the well, both the water level and bottom of well are measured to the nearest 0.01 foot with an electric probe. Measurements are taken from the top of the casing and recorded in the logbook (described in section D-4). Also recorded in the logbook are any problems noted with the condition of the well. The probe is rinsed in distilled water immediately before lowering it into the well and after removing it from the well. If the well is heavily contaminated, additional rinses may be required as described in section D-2.

2. Immiscible layers. Fuel products are the only immiscible organic layers encountered at Tinker. Because fuels float on water, procedures for floating layers only are included in this plan. The following procedures are followed where floating layers exist.

1. A hollow-core weight attached to a steel tape (plunker) is lowered into the well to determine the liquid level.

2. An electronic probe is used to determine the level of the oil/water interface.

3. The depth of the product layer is obtained by subtracting the liquid level depth from the interface depth.

3. Well evacuation procedures. Standing water within the well will be removed so that fresh formation water can be sampled. This water can be pumped onto the ground in wells whose concentration of contaminants is very low or where no history of contamination exists. In all other wells (where high concentrations of contamination exist or where contamination is unknown), purge water will be collected for appropriate disposal. Slowly recharging wells are pumped dry and sampled as soon as there is sufficient recharge to fill the sample containers. Wells which cannot be evacuated to dryness are pumped for a sufficient period of time to remove 3 casing volumes of water. Sampling normally occurs immediately after evacuation but never lags well evacuation by more than 24 hours. Non-dedicated

purging equipment is thoroughly scrubbed and rinsed with distilled water between wells. In heavily contaminated or unknown situations, additional rinses are performed as described in section D-2. Care is taken to prevent soil from contaminating the purging equipment. Three well types exist at TAFB, and details of evacuation procedures for each are listed below.

a. Open Wells. Some of the monitoring wells at Tinker are open wells. These wells, which do not contain dedicated equipment, are purged using a portable purging system and sampled with a teflon bailer. The portable system consists of a submersible pump, electrical wire, and discharge pipe. The purge pump is operated by a portable generator. This equipment is lowered into the well using a stainless steel cable. After purging, the equipment is raised from the well and completely cleaned using a distilled water sprayer and a brush. The bailers are taken to the field lab and cleaned as described in section D-2. For heavily contaminated wells, the purging system is also cleaned in a similar manner.

b. Base Water Supply Wells. There are 28 water wells which pump from the Garber/Wellington at Tinker. The water levels in these wells are about 200 feet deep, and the pumps are about 600 to 700 feet deep. The sampling equipment does not fit into the wells, and all wells are sampled with the well pumps at a port as near the well head as possible.

c. Dedicated Wells. Some wells are equipped with both purge pumps and bladder sample pumps. The purge pumps will be used for well evacuation and the bladder pumps will be used to obtain a sample.

4. Well sampling.

a. General. The only equipment used to remove a groundwater sample from a well is a dedicated teflon bladder pump or a teflon bailer. The pump rate of the bladder pumps is about 100 ml/minute, which is slow enough to prevent agitation. Two types of teflon bailers are used. For sampling volatile compounds, a bottom discharge bailer is used which has a teflon-coated wire attached to a ball which covers the opening. The flow rate from this opening is carefully controlled by pulling back on the wire. The pre-cleaned sample containers are carefully filled from this bailer allowing no headspace. The remainder of the samples are taken with a higher volume top discharge teflon bailer. Bailers are not dropped into the wells. Each sample container is filled directly from the bailer or discharge tube of the pump. A common container is not used. The sampling containers used for each type of analysis are listed in table 1. Extra care is taken to prevent sample contamination through carelessness. Sampling equipment or containers are not placed on the bare ground. Plastic sheets are available to provide a clean working surface. Sampling of background wells is performed before sampling of downgradient wells. Samples from each well are taken in the order listed on table 1.

c. Special procedures. PH and specific conductance are determined at the well with pH and conductivity meters before additional samples are taken. Enough sample is collected to fill a beaker sufficiently to allow the meter electrodes to be immersed. For pH, the meter is calibrated with two buffer solutions, either pH 4.0 and 7.0 or pH 7.0 and 10.0, and the pH is measured and recorded to the nearest 0.05 unit.

The electrodes are rinsed with distilled water between each sample or calibration. After the pH is measured, the specific conductance is determined in a similar manner, following the directions with the conductivity meter. The temperature must be known, and is taken with the pH meter. This sample is discarded after pH and specific conductance measurements are completed. When sampling through fuel layers is necessary, a one-half inch diameter tube with a stopper is lowered through the fuel layer to the groundwater below. The stopper is then blown out of the tube with a short blast of compressed air. Water is then drawn into the tube using a vacuum pump, thereby avoiding withdrawal of the sampling apparatus up through the fuel layer.

d. Sampling strategy. The sequence of operations for sampling is as follows:

1. Evacuate slowly recharging wells at the outset of the sampling day.
2. Evacuate and sample other wells.
3. Sample slow rechargers, if possible.
4. Return to lab, filter and preserve samples.
5. Prepare samples for shipment.
6. Deliver samples to bus station.

C. Soil and Bedrock Sample Collection.

1. General. The majority of the soil samples are taken by a drilling rig. Overburden and fill materials are sampled with a flight auger. Rock samples are taken with a core barrel. Each run with the auger is between 1 and 3 feet in length. Only the interior portion of the auger sample is used, and some material is taken from all of the lower flights. Rock core samples are broken up, and the interior portion, which is free from the influences of drilling fluid, is sampled. Samples of rock are taken in permeable zones as needed. Samples for soil classification and inorganic testing are placed in pre-cleaned quart glass jars. Samples for volatile organics and semivolatile organics/pesticides are put in separate quart glass jars with a teflon-lined cap. The organic samples are refrigerated and shipped to the laboratory in ice chests in order to meet the five day holding time required by the test methods. All soil and rock samples are shipped to the Corps of Engineers laboratory in Dallas by bus.

2. Special Procedures. Each site will have at least one boring drilled outside of the known limits of contamination. Samples from this boring are used to establish the background limits of contaminants at each site. Samples from this boring also serve as the travel blanks discussed in section F-1. All drilling and sampling equipment is decontaminated as described in section D-2. Equipment rinsate samples are collected and analyzed along with the soil samples as described in section F-1. Drilling fluid from contaminated areas is collected and disposed of in a suitable manner.

Table 1 - Water Sampling Procedures for Selected Parameters

parameter	container size	type	refrigeration required	preparation
pH and conductivity	1, 1/2 pt	either	no	do in field, see instructions
temperature	1, 1/2 pt	either	no	do in field
volatile organics	3, 40 ml	glass *	yes	brim full, no air bubbles or agitation
semi-volatile organics (BNA + Pesticides/PCB)	3, liter	glass	yes	brim full, no air bubbles or agitation
phenols	liter	glass	yes	sulfuric acid to pH <2
cyanide	liter	plastic	yes	sodium hydroxide to pH >12
TOX	1, liter	glass	yes	fill to brim and add 1ml of 1.1 M sodium sulfite
TOC	1, 40 ml	glass	yes	fill to brim. hydrochloric acid to pH <2
BTX	1, 40 ml	glass	yes	brim full, no air bubbles or agitation
total hydrocarbons	1, liter	glass	yes	none required
metals, total and fluoride	liter	plastic	no	nitric acid to pH <2
chloride and sulfate	liter	plastic	yes	none required
nitrate	liter	plastic	yes	sulfuric acid to pH <2
radium, alpha, and beta	liter	glass	no	nitric acid to pH <2
TDS, total phosphate, and turbidity	liter	plastic	yes	none required

* All glass containers have teflon-lined caps.

3. **Sampling Strategy.**

a. Label sample jars.
b. Place samples in jars.
c. Place samples in a cooler.
d. Prepare coolers for shipment.
e. Deliver coolers to bus station.

D. Handling and shipment.

1. **Preservation.**

a. Refrigeration. Samples are kept under refrigeration as much as possible. After collection is complete, the samples are put into a refrigerator. They are removed for filtration and preservation, and returned to the refrigerator until they are put into ice chests for shipment.

b. PH Adjustment (water samples only). Acids (hydrochloric, sulfuric, and nitric) and bases (sodium hydroxide) are added to adjust the pH of the sample to prevent chemical reactions which would change the concentration of the parameter to be tested. Acids and bases are added with a dropper bottle, testing the pH with a meter until it is at the required level.

c. Filtration (water samples only). Dissolved metal samples are prepared by filtering out the particulate material from the sample. This is done by using a coarse filter (fiber glass) and a fine filter (.45 micron) in a vacuum filtering apparatus.

2. **Cleaning.**

a. Water Sampling Equipment. Bailers, are cleaned at the end of the work day. Enough clean bailers are taken in the field each day so that they are not reused in that day's sampling. They are transported in clean containers, and care is taken to avoid contamination. Bailers are washed with a non-phosphate detergent, tap water, distilled water, and hexane, in that order. An intermediate acetone rinse was discontinued because it could not be adequately removed from the bailer. Between samples, the filtering apparatus should be cleaned with dilute hydrochloric or nitric acid (0.1 N) and washed with distilled water. At the end of the day, it should be thoroughly cleaned. Sampling equipment not used for organics may be cleaned with dilute hydrochloric acid and distilled water as described above.

b. Drilling and Soil Sampling Equipment. Steam-cleaned drilling equipment (augers, bits, rods pins, wrenches, etc.) are used to begin each soil boring. When possible, enough equipment is cleaned for an entire day's work. All sampling tools (knives, spoons, etc.) are cleaned as described above for bailers.

c. **Workers' Clothing.** All members of the sampling crew wear a new pair of gloves to begin each soil boring. The person who actually takes the samples wears disposable plastic gloves and changes them between each sampling interval.

3. **Shipping.** Samples are shipped to the laboratory in ice chests fitted with styrofoam inserts. These inserts have cutouts to accommodate the glass containers to be shipped. Each label on a container is covered with a strip of wide tape to protect it. The glass containers are placed into the styrofoam cutouts and the plastic containers into the spaces between the glass containers. The ice chest is filled with ice, and the data sheet and chain of custody form (described below) are inserted into a ziplock bag and taped to the inside lid of the ice chest. The ice chest is sealed with duct tape or fiber tape and delivered to the bus company for overnight shipment.

4. **Paperwork.**

a. **Fieldbook.** A fieldbook is kept of all operations and records the following for water samples: well number, date, water level, well evacuation procedure and rate of recharge, sample method, pH and conductivity readings, any unusual conditions noted (odor or color of water, well damage, etc), time of collection, time of preservation, time dropped off at bus station, names of samplers, and any information regarding blanks. For soil samples, the following information is recorded: boring number, date, sample method, number and depth of samples taken, presence of groundwater, any unusual conditions noted (odor or color of soil, etc.), name of sampler, time of collection, time dropped off at bus station, and any information regarding blanks. The information from the field book will be transferred to the two forms described below.

b. **Field data form.** This form, shown in Appendix A, includes selected information transferred from the log book. It is shipped in the ice chest.

c. **Chain of custody form.** The chain of custody form, also in Appendix A, is required to establish possession of the samples from their collection to their final receipt in the laboratory. It is filled out from the information in the logbook, and enclosed in the ice chest.

E. Laboratory testing. All samples (except for 10% of the perimeter well metal samples which are tested by the Oklahoma State Department of Health) are shipped by bus to the Corps of Engineers Southwestern Division (SWD) Laboratory, 4815 Cass Street, Dallas, Texas 75235. This laboratory tests primarily metals and other inorganic parameters. The organic and radiometric samples are shipped in their ice chests the same day to other laboratories under contract with SWD laboratory. A QA/QC plan of SWD Laboratory is enclosed in Appendix B. Qualifications for SWD's contract laboratories are also given in this appendix.

F. Quality assurance.

1. Field blanks. Blanks are used to verify that the sample collection and handling processes have not resulted in cross contamination. Two types of blanks prepared and are described below.

a. Travel blanks. Travel blanks for water samples are distilled/deionized water in sampling containers. Sampling frequency is one sample per crew per week/or well group. These blanks are analyzed for different parameters each week scheduled so that all parameters for which a particular group of wells are being sampled will have been tested for in a travel blank during that sampling period. Travel blanks for soil samples are soil from a known clean source in sampling containers. Sampling frequency is one sample per crew per week/or site. Analytical parameters are varied so that all the stipulated parameters for that site will have been tested for in a travel blank during that sampling period. All travel blanks are prepared as though they were an actual sample and shipped in a separate ice chest.

b. Equipment blanks. Equipment blanks for both soil and water samples are distilled/deionized water which is in contact with the cleaned, non-dedicated equipment (augers, knives, spoons, bailers, etc.). Frequency of collection of equipment blanks is the same as for travel blanks. These samples are prepared as though they were an actual sample with the same preservation and filtration procedures as described above. They are shipped in the ice chest with the trip blanks.

2. Laboratory procedures. Laboratory QA/QC procedures follow the Environmental Protection Agency Contract Laboratory Protocols. Detection limits, extraction and analysis dates, blanks, spikes, and duplicates are reported with the analytical data. Appendix B is the SWD laboratory QA/QC plan.

APPENDIX A

FIELD DATA AND CHAIN OF CUSTODY FORMS

GROUNDWATER MONITORING WELL FIELD DATA FORM

Location _____ Date _____

Site _____ Type of sample _____

Well number _____ Csg diameter _____ Csg type _____

Rate of recharge _____

Riser elevation _____

Depth to water from top of casing _____ Time of measurement _____

Depth to water at time of sampling _____ Time of sampling _____

Water table _____ Measuring device _____

pH _____ Time of measurement _____

Meter type and model _____

Conductivity, umhos/cm _____ Time of measurement _____

Meter type and model _____ Temperature _____

Chest # _____ Strap # _____ Bus bill _____

Notes concerning condition of well, odor, color, and any problems:

_____

_____

_____

_____

Sample collector _____

GROUNDWATER MONITORING WELL CHAIN OF CUSTODY RECORD

TULSA DISTRICT, CORPS OF ENGINEERS

Location _____ Date _____

Site _____ Well number _____

Number of containers in shipment

	glass	plastic
liter	_____	_____
vial	_____	

Parameters sampled

pH	____
conductivity	____
TOC	____
hardness as CaCO3	____
metals, total *	____
COD	____
hexavalent chromium	____
alkalinity	____
chloride	____
sulfate	____
TDS	____
nitrate	____
volatile organics	____
semi-volatiles	____
total hydrocarbons	____
BTX	____

* As, Ba, Be, Cd, Cr, Pb, Hg, Ni, Se, Ag, Zn, Fe, Mn, Mg, K, Na, Ca, Cu

* ____ (all of above)

CUSTODY RECORD
signature and title

Relinquished by	Received by	Date	Time
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

SOIL BORING SAMPLES
FIELD DATA FORM

Location _____ Date _____

Site _____ Hole number _____

Top of Hole Elev._____ Water Table _____

Depth			Description	Jar No.
_____	to	_____	_____	____ of ____
_____	to	_____	_____	____ of ____
_____	to	_____	_____	____ of ____
_____	to	_____	_____	____ of ____
_____	to	_____	_____	____ of ____
_____	to	_____	_____	____ of ____

Chest # _____ Strap # _____ Bus bill _____

Chest # _____ Strap # _____ Bus bill _____

Notes concerning condition of well, odor, color, and any problems:

_____

_____

_____

_____

Sample collector _____

SOIL BORING SAMPLES
CHAIN OF CUSTODY RECORD

TULSA DISTRICT, CORPS OF ENGINEERS

Location _____ Date _____

Site _____ Hole number _____

Number of containers in shipment: liter_____ vial_____

Parameters sampled

ph	____	volatiles	____
conductivity	____	semi volatiles	____
TOC	____	acid extractables	____
BTX	____	base neutrals	____
metals, 8 toxic	____	pesticides	____
metals, total	____	PCB's	____
cyanide	____	total hydrocarbons	____
oil and grease	____	EP Toxicity,metals	____
phenols	____	EP Toxicity,organic	____
TOX	____		____
TNT, DNT, RDX	____		____

* As, Ba, Be, Cd, Cr, Pb, Hg, Ni, Se, Ag, Zn, Fe, Mn, Mg, K, Na, Ca, Cu

* ____ (all of above)

CUSTODY RECORD
signature and title

Relinquished by	Received by	Date	Time
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

APPENDIX B

SOUTHWESTERN DIVISION LABORATORY
QA/QC PLAN

Report on Quality Assurance and Quality Control of Chemistry Unit Southwestern Division Laboratory US Army Corps of Engineers

04 November 1987

A. Jeffrey Tye, Chief Chemist

1. Provide work assignments, coordiante projects
2. Maintain QA/QC program
3. Train personnel
4. Purchase equipment, materials, outside services
5. Consult engineers, geologists, field personnel

B. Paula Wright, Technician

1. Wet chemistry
2. Sample receiving
3. Computer operations, data management

C. Leon Peterson, Technician

1. Sample preparation and analysis for trace metals
2. Wet chemistry
3. QA/QC coordinating

D. Resumes (see following pages)

A. Jeffrey Tye, Chief Chemist

1. Provide work assignments, coordiante projects
2. Maintain QA/QC program
3. Train personnel
4. Purchase equipment, materials, outside services
5. Consult engineers, geologists, field personnel

B. Manfred Ray, Chemist, Microbiologist

1. Preparation and analysis of environmental samples for organic and inorganic analysis
2. Microbiological analyses
3. Asbestoes identifications

C. Paula Wright, Technician

1. Wet chemistry
2. Sample receiving
3. Computer operations, data management

D. Leon Peterson, Technician

1. Sample preparation and analysis for trace metals
2. Wet chemistry
3. QA/QC coordinating

E. Mark Hansen, Technician

1. Wet chemistry
2. Special projects

F. Resumes (see following pages)

2017 Moser Ave. #140
Dallas, Texas 75206
Res. (214) 827-1643

JOB OBJECTIVE: Project or profit center management with a technology driven organization.

EXPERIENCE

SOUTHWESTERN DIVISION LABORATORY, U.S. ARMY CORPS OF ENGINEERS, Dallas, Texas

(1982-Present) Chief Chemist

Supervise and coordinate chemical analyses for all hazardous waste site investigations and engineering designs conducted by Southwestern Division. Supervise two other chemists, three to five technicians, report to Laboratory Director. Responsible for $900,000 budget.

Consult District engineers on protocols for sampling, chain-of-custody, analytical methods and selection of parameters. Train field personnel in sampling, safety and field testing. Consult Division engineers in development of Quality Management Plans for environmental projects.

Inspect all commercial laboratories which provide analytical services. Write contract requirements, manage sample data flow.

Altered procedures, purchased capital equipment, instituted QA/QC program, trained personnel resulting in 50% reduction in turnaround time, 40% increase in revenues. Solidified Laboratory's position for providing analytical services to Division and Districts outside of Division.

(1981-1982) Chemist

Through in-house and outside training, developed expertise in organic and inorganic analysis of environmental samples. Instrumentation, wet methods. EPA, Corps, A.S.T.M. and other methodologies. Promoted.

N.D.E.-AIDS, INC.
Fort Worth, Texas

(1979-1980) Chemist, Metallographer

Coordinated all phases of destructive and nondestructive testing for casting and forging evaluations for regional aerospace industries; performed failure analyses for litigations. Documented all testing methods performed by laboratory.

AN-TECH LABORATORIES, INC.
Houston, Texas

(1978-1979) Chemist

Provided chemical analyses of wide range of alloys, some highly specialized. Regular customer contact. Offered promotion.

TEXAS YOUTH COMMISSION
Crockett, Texas

(1977) Case Worker

Worked with and counseled delinquent youths in wilderness environment.

EDUCATION

(1983-1985) SOUTHERN METHODIST UNIVERSITY, Dallas, Texas.
M.B.A. Academic emphasis: Finance.

(1977-1978) UNIVERSITY OF CALIFORNIA AT DAVIS,
Davis, California
Graduate work in organic chemistry

(1972-1977) MILLSAPS COLLEGE, Jackson, Mississippi.
B.S. in Chemistry. Degree Accredited by American Chemical Society; four times Dean's List, 150 semester hours.

PERSONAL Volunteer for Committee for Foreign Visitors - Council on World Affairs, active in swimming, sailing, racketball, travel.

PAULA DIANE WRIGHT
2524 Waits Avenue
Fort Worth, Texas 76109
(817)924-4433

OBJECTIVE: GEOLOGIST or GENERAL ANALYST for a company involved in environmental sampling, analysis, and/or treatment of groundwater.

EDUCATION: UNIVERSITY of TEXAS at AUSTIN, Austin, Texas.
Degree: BS Geology.
September, 1978 - May, 1984.

EMPLOYMENT: U.S. ARMY CORPS of ENGINEERS, SW Division Lab, Dallas, Texas
PHYSICAL SCIENCES TECHNICIAN, Chemistry Section.
Perform data management using an IBM PC AT with Wordstar, Lotus, dBase III.
Prepare and analyze environmental samples by EPA methodologies.
Atomic Absorption Spectrophotometry, TRAACS 800, wet methods.
February, 1986 - present.

REED OPERATING COMPANY, INC., Fort Worth, Texas.
GEOLOGIST.
Contoured maps, correlated logs, drew cross sections, drafted.
Created prospects, assisted in writing of prospect brochures, library research work.
Well site experience.
November, 1984 - November, 1985.

THOMAS D. COFFMAN, INC., Oil Producer, Austin, Texas.
LAND AND GEOLOGICAL TECHNICIAN.
Entered well data on Digital VT-100.
Set up files and card files for all lessees.
Assisted in delay rental payments, lease recordings.
June, 1982 - May, 1984.

ENGINEERING AIDE
Distributed drilling reports and production to investors.
Recorded production graphs.
Assisted in filling out Railroad Commission forms.
September, 1980 - May, 1981.

WOODBINE CORPORATION, Fort Worth, Texas.
SECRETARY'S AIDE.
June - August, 1981, 1977, 1976.

ACTIVITIES: American Association of Petroleum Geologists
Association of Groundwater Scientists and Engineers
Texas Exes Association
Interests: Skiing, scuba diving, sewing, reading.

PERSONAL: Date of Birth: March 26, 1960
Marital Status: Single

REFERENCES: Available upon request.

Leon Peterson
2305 Southern Oaks Dr. #2022
Arlington, TX 76011

OBJECTIVE

. Seeking position utilizeing Engineering and Chemistry Lab Skills

EDUCATION

University of Utah: 1982 - 1984
Salt Lake City, Utah

University Texas Arlington: 1984 - Present
Mechanical Engineering

SUMMARY OF QUALIFICATIONS

Excellent knowledge of computer operations
Maintaining accurate information and reports
Keeping current business up-to-date
Excellent people skills
Very mechanically inclined.
Work well alone and as a team member

EMPLOYMENT HISTORY

1986-Present SWD Laboratory, Chemistry Technician
Trace Metal-Analysis
Wet Methods for Various Analytes
Gas Chromatography
Perkin-Elmer Model 500 HGA Furance
Model 5000 A.A. Spectrophotometer
Perkin-Elmer Sigmal Gas Chromatograph
O.C. TOC-TIC Analyllzer

1985-1986 Simuflite training/DFW Airport, Texas
Technician. Set up and managed simulator discrepancy system, worked with electronics and aircraft systems, operated H.P. and CDC Computers.

1984-1985 Airborne Freight, Salt Lake City, Airport, Utah
Night Ramp Supervisor and Driver. Managed the loading of DC-9 aircraft, calculation of weight and balance, flagged out night planes.

1982-1983 Rocky Mountain Wrecker, Salt Lake City, Utah
Steel Fabricator. Performed steel fabricating and welding, set up hydraulic systems and wiring electrical systems of wreckers.

PERSONAL Born: 6/13/64... Single...Excellent Health

I. Equipment

A. Instrumentation

Item	Manufactures	Model	No.	Age, Yr
pH Meter	Cole-Parmer	5986-60	1	1
Specific Ion Analyzer	Orion	901	1	9
Conductivity Meter	Barnstead	PM 70-CB	1	1
UV-Visible Spectrophotometer	B & L	Spectronic 100	1	10
Atomic Absorption Spectrophotometer	Perkin-Elmer	401	1	13
	Perkin-Elmer	5000, HGA 500	1	2
Carbon Analyzer	O.I.	700	1	1
Gas Chromatograph	Perkin-Elmer	Sigma-1	1	8
Kjeldahl Digestion System	Labconco		1	11
TOD Analyzer	YSI	54A	1	2
Continuous Flow Analyzer	Technicon	TRAACS 800	1	1

B. General Laboratory Equipment

Item	Manufacturer	Model	No.	Age, Yr
Oven (Convection)	Blue M	OV-18C	1	28
Oven (Radiant Heat)	Lab Line	Imperial III	1	8
Oven (forced draft)	Blue M	OV-500	1	28
Furnace	Hoskins		1	28
	Heavi Duty		1	28
Refrigerator, 3x5x8	Nor-Lake		6	5
Refrigerator, 3x3x5	Kenmore	19	2	7
Fume Hood	Labconco		3	10
1-1/2 x 2-1/2 x 8	Unknown		1	28
Distillation System	Barnstead	A-1013	1	3
Ion Exchange System	Millipore	Milli-Q	1	8
Centrifuge	IEC	2K	1	9
	IEC	EXD	1	23
	Lab Line	Imperial III		9
	Barnstead	1250		9
Balance	Fisher	B-6	2	20
	Mettler	PC400	1	10
	Mettler	K-7	1	20
Cell Disruptor	Heat Systems	W-375	1	4
Roto Evaporator	Buchii	B-465	1	5
Ultrasonic Cleaner	Mettler		1	7
Water Bath	Blue M		2	6
Vortex Mixer	S/I	K-550-G	1	4
Autoclave	Barnstead	1250	1	7
Ampule Sealer	O.I.C.		1	1
Vacuum Pump	Lammert		2	3

III. Source of Methodologies

A. Methods for Water, Wastewater, Soils and Sediments

1. United States Environmental Protection Agency/U.S. Army Corpsof Engineers. Procedures for Handling and Chemical Analysis of Sediment and Water Samples. Environmental Laboratory, U.S. Army Engineer Waterways Experiment Station; Vicksburg, Mississippi. (1981)

2. United States Environmental Protection Agency. Methods for Chemical Analysis of Water and Wastes. EPA; Cincinnati, Ohio. (1979).

3. American Public Health Association. Standard Methods for the Examination of Water and Wastewater. 16th Edition APHA; New York, New York. (1985).

4. Army Corps of Engineers. Ecological Evaluation of Proposed Discharge of Dredged or Fill Material into Navigable Waters. Environmental Effects Laboratory, U. S. Army Engineer Waterways Experiment Station. (1976).

5. Test Methods for Evaluating Solid Waste Physical/Chemical Methods. SW-846. (1982). United States Environmental Protection Agency

6. Contract Laboratory Program Statement of Work Inorganic Analysis Multi-Media Multi-Concentration. July 1984 United States Environmental Protection Agency.

B. Methods for Construction Materials

1. American Society for Testing and Materials. Annual Methods. A.S.T.M. Philadelphia, PA (1985)

2. Army Corps of Engineers Handbook for Concrete and Cement US Army Engineer Waterways Experiment Station (1985).

IV. Methods Routinely Followed

A. Constituent	Method Source	Method Number
Preparation of aqeuous and Soil Samples for Flame Absorption Spectroscopy	5	3010
Preparation of Soils for HGA Atomic Absorption Spectroscopy	5	3020
Antimony	5	7040
Arsenic	In House	HGA, See attachment
Barium	5	7080
Beryllium	5	7090
Cadmium	5	7130
Chromium	5	7190
Lead	In House	HGA, See attachment
Mercury	3	303F
Nickel	5	7520
Selenium	In House	HGA, See attachment
Silver	5	7760
Thallium	5	7840
Other Metals	1	
Extraction of Organochlorine Pesticides and PCBs from aqueous samples	5	3510
Extraction of Organochlorine Pesticides and PCBs from soil samples	5	3550
Organochlorine Pesticides and PCB's	5	8080
Chlorinated Herbicides	5	8150

Nitrogen-Kjeldahl, Total in aqueous samples	2	351.3
Nitrogen-Kjeldahl, Total in soil samples	2	350.2
Oil and Grease	2	413.1
Chloride	3	407B.
Flouride	3	413B
Sulfate	3	426.C
Phosphorous	3	424D
pH	2	150.1
Conductivity	3	205
EP Toxicity Preparation	5	1310
Elutriate Preparation	4	
Biochemical Oxygen Demond	3	507
Chemical Oxygen Demond	3	508
Fecal Colifdrm	3	908A-D
Cyanide	2	335.2
Total Organic Carbon	2	415.1

P Bound copies of Standard Operating Procedures are maintained and available to every analyst.

V. Initial Calibration and Calibration Verification

A. Standards shall be prepared using certified materials in the case of metals and organic analyses and reagent grade materials for other tests.

B. Data from standards shall be accumulated starting with the lowest concentration and ending with the highest.

C. Calibration shall be verified using another source of standard material. When available, an EPA Quality Control Sample could be used. Calibration should be verified at a frequency of at least 10%.

D. Calibration data shall be recorded on raw data sheets, which are kept in bound notebooks.

E. A method blank shall be prepared for every set of samples (defined as 20 samples or less) containing appropriate amounts of reagents used in sample preparation. Data from the blank shall be determined and recorded after calibration. If the method blank is above the required detection limit and if the lowest analyte is less than 10 x the blank concentration the entire sample set must be reanalyzed.

VI. Spiked Sample Analysis

A. Spiked samples shall be prepared starting with the initial step (digestion, extraction, etc) and be performed for every sample matrix at a frequency of not less than 10%. Spikes shall be prepared with certified reference material EPA Quality Control Check Samples or reagent grade material.

B. Individual percent recoveries shall be calculated as follows:

$$\text{Recovery} = \frac{(SSR-SR)\times 100}{SA}$$

where SSR = Spiked Sample Result
SR = Sample Result
SA = Spike Added

Data on spike recoveries is accumulate for each constituent on the Accuracy Control Chart shown in the attachment. Percent Recoveries outside of the range 75-125% shall be considered outliers. Spike recoveries shall be disregarded for samples in which the concentration is four or more times the spike amount. Original sample results which are less than the required detection limits shall be made equal to zero % recovery calculations.

VII. Duplicate Sample Analysis

A. A duplicate sample shall be prepared for each sample matrix at a frequency of not less than 10%.

B. The relative percent differences (RPD) for each constituent are calcualted as follows:

$$RPD = \frac{|D1-D2|}{(D1+D2)/2} \times 100$$

where RPD = Relative Percent Difference
D1 = First Sample Value
D2 = Second Sample Value (duplicate)

RPD data is collected for each constituent on the precision control chart shown in the attachment.

C. Results of duplicate analyses for samples with concentrations greater than 5 times the required detection limit shall have RPD <20% to be acceptable. Samples which have concentrations less than 5 times the required detection limit have a control limit such that RPD = required detection limit. RPD is not calculated for samples with concentrations less than the required detection limit.

VIII. Corrective Action

A. If some, but not all, Spikes and/or repeats are found to be outliers the sample set shall be reanalyzed using the same extract or digestate.

B. If all Spikes and/or repeats are lutliers, the entire sample set must be reanalyzed starting from the initial step. An investigation should also commence regarding the method, reagents, instrument condition and calibration and any other factors which may contribute to problems of precision and accurancy.

IX. External Quality Assurance Program

A. SWD Laboratory participates in a QA program as provided by U.S. EPA Environmental Monitoring and Support Laboratory of Cincinnati, Ohio, Oklahoma Water Resources Board and Analytical Products Group, Inc.

B. Analyses include trace metals, nutrients, minerals, chlorinated pesticides and PCB's.

C. The results of the analyses are used to make assessments of methodology selection and operation quality.

D. Audits are used to check the proficiency of individual analysts.

X. Instrument Maintenance

* A. Atomic absorption spectrophotometers models 403, 5000, and HGA 500 along with gas chromatograph model Sigma 1 are covered under service contracts with the Perkin-Elmer Corp.

B. Other instrumentation is maintained in-house.

XI. Chain-of-Custody Procedures

A. All samples are received in a designated area of the SWD Laboratory by a designated sample custodian.

B. Written notification is provided to client district using SWD receiving form along with chain-of-custody forms provided by district.

C. An in-house sample number is assigned to each sample.

D. Records of samples which include all information provided by district and SWD Lab number are maintained in log books and in microcomputer files.

E. Chain-of-custody forms accompany all samples which are sent to other laboratories for analysis. Forms are returned to SWD laboratory and kept on file.

XII. Sample Storage

A. Samples are stored at 4 C (checked and recorded daily) in six 3x6x6 refrigerators.

B. Samples are stored for a minimum of six weeks after data has been submitted and are then discarded.

C. Samples known or suspected to be classified as hazardous waste shall be retained by the laboratory until arrangements have been made for legal disposal.

D. Volatile and semivolatile samples are stored separately.

XIII. Reporting System and Record Keeping

A. Written reports are submitted after project is completed.
1. Report identifies samples by districts identification as well as by SWD Laboratory numbers.

2. Minimum reportable concentrations are submitted with each constituent reported.

3. Reports include, data on surrogate recoveries and repeats applicable to the data set.

B. Information is available by telephone, computer interface or modum or computer disk.

C. Laboratory Director maintains files of all reports submitted to client districts.

D. Chemistry unit maintains files of raw data used for generating reports, hard copy of final reports and computer backup of reports submitted by computer disk.

XIV. Training

A. Full time employees receive periodic outside training in environmental analysis, sampling, hazardous waste management and computer operations.

B. Students and part time employees receive one-on-one training from the lead chemist, observe slide presentations produced by Savant Corp. and must demonstrate proficiency before being allowed to analyze samples.

XV. Safety

A. Laboratory is equipped with four overhead showers, two eye washers, and four fire extinguishers.

B. Personnel are provided with lab coats, disposable aprons, gloves and protective eye wear and are also given medical examinations annually.

C. Personnel are trained in safe laboratory procedures and laboratory participates in the J.T. Baker Safety program.

XVI. Sampling

A. All sampling will be performed in accordance with Characterization of Hazardous Waste Sites - A Methods Manual Volume II. Available Sampling Methods. Second Edition EPA 600/4-84-076.

B. QA field splits or duplicates most be taken at a frequency of one per matrix type or one per each set of ten samples of each matrix type which ever is greater.

C. QA blank samples are required for each matrix

type or one per each set of ten samples or each matrix type whichever is greater. Blanks may be rinsates, distilled water, background water, and clean or background soil.

XVII. Sample Handling

A. Low Concentration Samples - Low level samples are considered to be those collected off-site, around the perimeter of a waste site, or in areas where hazards are thought to be significantly reduced by normal environmental processes.

1. Water, Organics

a) Bottle and Preservative Requirements

* Four 1-liter (or two 80 ounce or two half-gallon) amber glass bottles (Teflon-lined caps), iced to 4C (may not be held at site over 24 hours). Remember: Leave headspace!

* Two 40 ml glass VOA vials (Teflon-lined caps), iced to 4 C (may not be held at site over 24 hours). Fill completely! All air bubbles should be excluded.

* The samples above are needed when Method 624 or 1624 is used to analyze for volatile (or purgeable) organics, when Method 625 or 1625 is used to analyze for Acid/Base Neutral (A/B/N) extractable organics, and when Method 608 is used to analyze for pesticides and PCB's. Other methods may have different preservation techniques. Be sure to preserve the sample properly if a method other than 608, 624, 1624, or 1625 is planned.

Paperwork/Labels

* Chain of Custody Record. See attached example. It is important to note that only one site may be listed per form even if the sites have the same project number. Top original goes with the samples: a copy should be saved for the sampler's files.

* Receipt for Samples. See attached example. This form complies with the requirements that the owner, operator, or agent-in-charge is legally entitled to i) a receipt describing the samples obtained from the site and; ii) a portion of each such sample equal in weight or volume to the portion retained, if requested. The original form is retained for the Project Coordinator and a copy is given to the owner, operator, or agent-in-charge.

* Labels/Sample Tags. See attached example. You must label the sample with a date, time of collection, site name, and brief description on a label that will not float or soak off - no masking tape, please. Use only indelible ink on all labels and tags. Numbered sample tags should be used on all samples.

c) Packaging and Shipping.

* Waterproof metal (or equivalent strength plastic) ice chests or coolers only.

* After filling out the pertinent information on the sample label and tag, put the sample in the bottle or vial and screw on the lid. For bottles other than VOA vials, secure the lid with strapping tape. (Tape on VOA vials may cause contamination.) Then, secure the string from the numbered approved tag around the lid.

* Mark volume level on bottle with grease pencil.

* Place about 3 inches of inert cushioning material such as vermiculite in the bottom of the cooler.

* Enclose the bottles in clear plastic bags through which sample tags and labels are visible, and seal the bag. Place bottles upright in the cooler in such a way that they do not touch and will not touch during shipment.

* Put in additional inert packing material to partially cover sample bottles (more than half-way). Place bags of ice around, among, and on top of the samples bottles.

* Fill cooler with cushioning material.

* Put paperwork (chain of custody record) in a waterproof plastic bag and tape it with masking tape to the inside lid of the cooler.

* Tape the drain shut.

* Secure lid by taping. Wrap the cooler completely with strapping tape at a minimum of two locations. Do not cover any labels.

* Attach completed shipping label to top of the cooler.

* Put "This Side Up" labels on all four sides and "Fragile" labels on at least two sides.

* Affix numbered and signed custody seals on front right and back left of cooler. Cover seals with wide, clear tape.

Remember that each cooler cannot exceed the weight limit set by the shipper.

2) Inorganics

a) Bottle and Preservative Requirements.

* Metals. One 1-liter high density polyethylene bottle (Teflon-lined cap), adjust to pH < 2 with 1:1 HNO3 (usually 3 mL). See notes 1 and 2 below.

* Cyanides. One 1-liter high density polyethylene bottle (Teflon-lined cap), adjust to pH > 12 with NaOH (usually 2 mL of 10N NaOH or 4 pellets), and 4 C. See note 1 below.

* Sulfide. One 1-liter high density polyethylene bottle (Teflon-lined cap), 4 mL 2.0 N zinc acetate and adjust pH > 9 with NaOH, and 4 C. See note 1 below.

* Fluoride. One 1-liter high density polyethylene bottle (Teflon-lined cap), no preservative, and 4 C.

* pH. No preservative. Must be measured immediately in field. Do not ship.

* Ammonia, Total Nitrogen, Organic Nitrogen, Nitrate/Nitrite. For each analyte, one 1-liter high density polyethylene bottle (Teflon-lined cap), adjust to pH < 2 with H2SO4 (usually 4 mL 1:1 H2SO4), and 4 C.

* Oil and Grease, Total Organic Carbon (TOC). For each analyte, one 1-liter glass bottle (Teflon-lined cap), 4 mL 1:1 H2SO4 (to pH < 2), and 4 C. See note 1 below.

Notes:

1. For quality control purposes, larger sample volumes of some samples are needed. If a water sample is sent from only one sample location, two 1-liter bottles for each separately preserved sample are needed. If there are more sample locations, one out of every five will require two 1-liter bottles for each separately preserved sample.

2. Water samples may require filtration on site before shipment. (This usually applies only to groundwater samples which are visibly cloudy.) Be sure to refer to the project Sampling and Analysis Plan for detailed instructions.

b) Paperwork/Labels.

* Inorganic Paperwork is the same as described for organics and includes the Chain of Custody Record, Receipt for

Samples, and Labels/Sample Tags. See ... explanations.

c) Packaging and Shipment

* Follow packaging and shipping requirements listed for orgainics. "Fragile" labels are optional for coolers not containing glass bottles.

In cases where ice is not required (metals), fill cooler with only packing material. Once again, remember that the cooler must not exceed the shipper's weight limit.

3. Soils/Sediments (Organics and Inorganics)

a). Bottle and Preservative Requirements

* Two 8-ounce glass wide mouth jars at least 3/4 full (Teflon-lined caps), no preservative, and iced to 4 C - one one jar for organics and one jar for inorganics. For analysis of volatiles in soil, either 2-40 mL VOA vials with Teflon septa completely full with no headspace are needed in addition (preferably) or 1 additional 8 oz. jar with Teflon-lined lid completely full. No preservatives and iced to 4 C are also required for volatile samples.

Note: For quality control purposes, larger sample volumes of some samples are needed. If a soil sample is sent from only one sample location, four 8-ounce bottles are needed, two for organics and two for inorganics. If there are more sampling locations, one out of every five will require four 8-ounce bottles.

b) Paperwork/Labels

* Follow paperwork requirements listed for water samples above. See attached example of forms.

c) Packaging and Shipping

* Follow packaging and shipping requirements for water samples detailed above. Be sure that the shipping cooler does not exceed the shipper's weight limits.

B. Medium Concentraction Samples - Medium level samples are most often those collected on-site, in areas of moderate dilution by normal environmental processes.

1. Waters/Liquids (Organics and Inorganics)

Note: Samples are not known to contain highly toxic compounds such as dioxin.

a) Bottle and Preservative Requirements

* four 32-ounce wide mouth glass jars (Teflon-lined caps), no preservatives, and iced to 4 C for A/B/N extractable organics.

* Two 40mL glass VOA bottles (Teflon-lined caps). Iced to 4 C. Fill completely. No preservatives.

* Two 16-ounce wide mouth glass jars nearly-full (Teflon-lined caps), no preservative - one for metals and one for cyanides.

b) Paperwork/Labels

* See previous examples. Follow paperwork requirements for low concentraction samples.

c) Packaging and Shipping

* Secure sample jar lids with strapping tape or evidence tape. At the same time secure string from USEPA numbered tag around lid.

* Mark volume level of bottle with grease pencil.

* Position jar in Ziploc bag so that tags may be read.

* Place about 1/2 inch of cushioning material in the bottom of metal can.

* Place jar in can and fill remaining volume of can with cushioning material.

* Close the can using three clips to secure the lid.

* Write sample number on can lid. Indicate "This Side Up" by drawing an arrow and place "Flammable Liquid N.O.S." label on can. Personnel who ship samples must be sure to comply with DOT shipping regulations and not knowingly over classify a sample prior to shipment. If the person shipping a sample knows that the sample is not a "Flammable Liquid" (i.e., a water phase sample or a soil sample), he should not classify it as "Flammable Liquid."

* Place about 1 inch of packing material in bottom of cooler.

* Place cans in cooler and fill remaining volume of cooler with packing material.

* Put paperwork in plastic bags and tape with masking tape to inside lid of cooler.

* Tape drain shut.

* After acceptance by shipper, tape cooler completely around with strapping tape at two locations. Secure lid by taping. Do not cover any labels.

* Place lab address on top of cooler.

Note: Write "Flammable Liquid N.O.S." on side of cooler if this is not marked on the margin of your DOT label.

* For all medium and high concentration shipments, complete shipper's hazardous material certification form.

* Put "This Side Up" labels on all four sides, "Flammable Liquid N.O.S." and "Danger-Peligro" on all sides.

Note: "Danger-Peligro" labels should be used only when net quantity of samples in cooler exceeds 1 quart (32 ounces) for liquids or 25 pounds for solids. In other words, for our purposes "Danger-Peligro" labels will never be used for Flammable Solids N.O.S.

* Affix numbered custody seals on front right and back left of cooler. Cover seals with wide, clear tape.

3. Soils/Sediments/Solids (Organics & Inorganics)

a) Bottles and Preservatives

* Two 8-ounce wide mouth glass jars, 3/4 full (Teflon-lined caps), no preservatives, one jar for organics and one jar for inorganics (metals and cyanide) or

* Four 4-ounce wide mouth glass jars, each 3/4 full (Teflon-lined caps), no preservative; two jars for organics and two jars for inorganics.

b) Paperwork/Labels

See previous examples. Follow paperwork requirements listed for low concentraction samples.

c) Packaging and Shipping

* Follow packaging and shipping requirements listed for medium concentration water/liquids above substituting "Flammable Liquid N.O.S." with "Flammable Solid N.O.S."

C. High Concentration Samples (Hazardous; Determined Not To Be A D.O.T. - Defined Poison A) - High concentration samples include those from drums, surface impoundments, direct discharges, and chemical spills, where there is little or no evidence of environmental dilution. High concentraction (or high hazard) samples are suspected to

contain greater than 15% concentration by wt. individual chemical substituent.

1. Liquids (Organics and Inorganics)

a) Bottle and Preservative Requirements

* One 8-ounce wide mouth glass jar filled 1/2 to 3/4 full (Teflon-lined cap). No preservative.

b) Paperwork/Labels

See previous examples. Follow paperwork requirements for water samples detailed above.

Shipper may require special forms to be completed before shipment of high hazard concentration samples.

c) Packaging and Shipping

Follow packaging and shipping requirements listed above for medium concentraction water/liquids.

2. Soils/Sediments/Solids (Organics & Inorganics)

a) Bottle and Preservative Requirements

* One 8-ounce wide mouth glass jar filled 1/2 to 3/4 full (Teflon-lined cap). No preservative.

b) Paperwork/Labels

* See attached examples. Follow paperwork requirements above.

c) Packaging and Shipping

* Follow packaging and shipping requirements for medium concentration water/liquids, substituting "Flammable Liquid N.O.S." with "Flammable Solid N.O.S."

XVIII. Transfer of samples to Contract Laboratories

A. Samples which are to be transferred to contract laboratories are shipped within twentyfour hours of receipt by SWD Lab.

B. Sample shipment includes samples, chain-of-custody documentation, explicit instructions as to sample identifications, required analyses, methods, required turnaround time and date that samples were taken.

C. Samples are shipped in coolers affixed in form fitting inserts and covered with ice. Coolers are secured with straps and chain-of-custody seals. Coolers are shipped for next day delivery by commercial carrier.

IXX. Requirements of Contract Laboratories

A. Certifications

1. Laboratories must be certified by the Oklahoma Water Resources Board for all analyses requested by SWD Lab.

2. Laboratories must be an active participate in EPA's Contract Laboratory Program for organic and/or inorganic analyses whichever is applicable or demonstrate equivalent capability and established laboratory practices.

B. Contractor must have a minimum duplicity of all major analytical equipment.

C. All analysts must have a minimum Bachelors Degree or five years of experience. All analytical group leaders must of a minimum of a Masters Degree and two years of experience or a Bachelors Degree and at least seven years of experience.

D. Contractors must submit laboratory quality control plans and facilities are inspected by SWD Lab personnel at least annually.

SOUTHWESTERN DIVISION LABORATORY, CORPS OF ENGINEERS
4815 CASS STREET
DALLAS, TEXAS 75235-8011
(214) 767-2411

REQUEST FOR ANALYTICAL SERVICES

LABORATORY: RADIAN CORP.

PROJECT: PINE BLUFF ARMY ARSENAL

FEATURE: GROUND WATER INVESTIGATION

SWD REPORT NO.:

REQUIRED COMPLETION DATE: 15 JAN 88

DATE SAMPLES SENT: 14 DEC 87

TEST THE FOLLOWING SAMPLES AS INDICATED BELOW:

FIELD NO.	SWD NO.	
186 TOTAL	7- 917	CHLOROBENZENE, TOX, PESTICIDES IN QUADRUPLICATE
186 DISSOLVED	7- 918	TOX ONLY IN QUADRUPLICATE
88 TOTAL	7- 919	CHLOROBENZENE, TOX, PESTICIDES IN QUADRUPLICATE
188 DISSOLVED	7- 920	TOX ONLY IN QUADRUPLICATE

ANALYZE 8 WATER SAMPLES FOR CHLOROBENZENE BY METHOD 602.

ANALYZE 8 WATER SAMPLES FOR PESTICIDES o,p-DDD, p,p-DDD, o,p-DDT, p,p-DDT BY METHOD 608.

ANALYZE 16 WATER SAMPLES FOR TOX BY METHOD 9020.

RETURN COOLERS TO TINKER AIR FORCE BASE OKLAHOMA.

RELINQUISHED BY	RECEIVED BY	DATE	TIME

Low and Medium Example

CHAIN OF CUSTODY RECORD

Proj. No.	Project Name					No. Of Containers								Remarks
Samplers (Signature)														
Sta. No.	Date	Time	Comp.	Grab	Station Location									

Important: Samples are first relinquished by the sampler (as above) who also signs the Shippers Certification from Federal Express.

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Si
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Si
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks:	

Low and Medium Concentration Example

RECEIPT FOR SAMPLES

Proj. No.	Project Name	Name of Facility

Samplers *(Signature)*

Facility Location

Split Samples Offered

( ) Accepted or ( ) Declined

Sta. No.	Date	Time	Comp.	Grab	Split Samples	Organic/Inorganic Traffic Report Nos.	Station Description	No. Of Containers Collected	Remarks Sample Mo
						Note: This form is required even if split samples are refused.			

Transferred by: *(Signature)*

Received by: *(Signature)*

Telephon

Date Time

Title Date Time

CHAIN-OF-CUSTODY-SEAL

SOUTHWESTERN DIVISION LABORATORY
US ARMY CORPS OF ENGINEERS
DALLAS, TEXAS

DEPARTMENT OF THE ARMY
SOUTHWESTERN DIVISION, CORPS OF ENGINEERS
PO BOX 36045, 4815 CASS STREET
DALLAS, TEXAS 75235-8011

(214) 767-2411
FTS 729-2411

District_____ Project_____

Location_____ Date_____ Time_____

Hole No._____ Sample No._____ Depth_____

Check One:

_____Extractable Organics (base/neutrals, acid and Pesticide)	_____Metals	_____TOX
	_____Phenols	_____Other
	_____Cyanide	_____
_____Volatile Organics	_____TOC	_____

Has Sample been Preserved?_____Yes _____No

Remarks_____

Sampler's Signature_____

OKLAHOMA WATER RESOURCES BOARD

Hereby Recognizes That

Corps of Engineers, S.W. Division Lab.

Laboratory No. 8602

is a participant in the Oklahoma Water Resources Board's LABORATORY CERTIFICATION PROGRAM and maintains on file a List of Parameters for which it is certified to perform analyses.

Done this 10 day of June, 1986

James R. Barnett Executive Director

This certificate is valid only for JANUARY 1 Through JUNE 30 1987

LABORATORY CERTIFICATION PROGRAM
UPDATED LIST OF CERTIFIED PARAMETERS FOR 1986

CATEGORY I (MINERALS), CATEGORY II (NUTRIENTS),
AND CATEGORY III (METALS & TOXIC SUBSTANCES)

****
Each laboratory shall provide a copy of this list
(including Category IV) to any of their clients that are
permitted by the Oklahoma Water Resources Board and/or EPA.
****

r 27, 1986

The following parameters are certified for the SECOND HALF of 1986. These are the parameters which were successfully analyzed in the Spring Test of 1986, or successfully analyzed in both the Spring and Fall Tests of 1985.

S OF ENG., SW DIVISION LAB ID # 8602

JEFFERY TYE TEL. (316) 767-2411
815 CASS STREET
DALLAS TX 75235

The following parameters are certified from 7-1-86 to 12-31-86

ardness	Chloride	Dis. Solids	Spec. Conductance
Ammonia-Nitrogen	Nitrate-Nitrogen	Tot. Phosphorus	pH
Aluminum	Arsenic	Barium	Cadmium
alcium	Chromium	Copper	Iron
Lead	Magnesium	Manganese	Nickel
Potassium	Selenium	Sodium	Zinc

1000 NE 10th STREET, P.O. BOX 53585
OKLAHOMA CITY, OKLAHOMA 73152

LABORATORY CERTIFICATION PROGRAM
UPDATED LIST OF PARAMETERS CERTIFIED FOR 1986

CATEGORY IV (MISCELLANEOUS)

*****

Each laboratory shall provide a copy of this list to any of their clients that are permitted by the Oklahoma Water Resources Board and/or EPA.

*****

ne 10, 1986

All of the following parameters are certified from July 1, 1986 to December 31, 986. The updated certification list for 1987 will be ready for distribution by nuary 1, 1987.

CORPS OF ENGINEERS (SOUTHWEST DIVISION LAB)
Antimony (Sb), Beryllium (Be), Cyanide, Oil and Grease, Silver (Ag), Thallium (Tl), TOC

JAMES R. BARNETT, Executive Director
MICHAEL R. MELTON, Assistant Director

OKLAHOMA WATER RESOURCES BOARD

P.O. BOX 53585 • 1000 N.E. 10TH STREET • OKLAHOMA CITY, OKLAHOMA 73152 • (405)271-2555

DATE: December 15, 1986

TO: Laboratory Director

FROM: Ron Jarman, Ph.D.
Chief, Water Quality Division

SUBJECT: List of Parameters Certified for 1987
and a Validation Decal for the Certificate

Enclosed is a List of Parameters Certified for 1987 and a validation decal for your certificate. Explanations of certification conditions are stated on the list. Instructions for placing the decal properly on the certificate are printed on the left side of the decal.

Please note that one of the conditions of a valid certificate is to maintain on file the List of Parameters for which your lab is certified to perform analyses. This means that at least one (1) copy of the list should be kept available in the laboratory at all times for clients to review and for OWRB's on-site inspection. In addition, it is the responsibility of each commercial/contract laboratory to provide a copy of this list and its I.D. number to any of its clients which are permitted by OWRB's Waste Disposal Permit Program and/or EPA's NPDES Program.

A list of certified parameters for all the commercial/contract labs in the Lab-Cert Program is also available from this office for $4.00. If you wish to have a copy of this list or have any questions concerning your certified parameters or the decal, please do not hesitate to contact Dr. Gene P. Chou at (405) 271-2545.

Enclosures as stated

LABORATORY CERTIFICATION PROGRAM
LIST OF PARAMETERS CERTIFIED FOR 1987

CATEGORY I (MINERALS), CATEGORY II (NUTRIENTS),
CATEGORY III (METALS & TOXIC SUBSTANCES),
AND CATEGORY IV (MISCELLANEOUS)

****

Each laboratory shall provide a copy of this list to any of their clients that are permitted by the Oklahoma Water Resources Board and/or EPA.

****

ec mber 15, 1986

+ ach parameter certified for the FULL year of 1987 (from 1-1-87 to 12-31-87) is the parameter which was successfully analyzed in both the Spring and Fall ests in 1986.

+ ach parameter certified for the FIRST SIX MONTHS of 1987 (from 1-1-87 to 6-30-87) is the parameter which was successfully analyzed only once in 1986, either in the Spring or the Fall Test. Any parameter under such certification would be extended to the second half of 1987 (from 7-1-87 to 12-31-87) if that particular parameter is successfully analyzed in the Spring Test of 1987.

arameters NOT successfully analyzed in either the Spring or the Fall est in 1986 are not shown on this list. But certification for such parameters would be given from 7-1-87 to 12-31-87 if they are successfully analyzed n the Spring Test of 1987.

ll of the Category IV parameters are certified for six months (from 1-1-87 to 6-30-87).

he updated certification list for the second half of 1987 will be ready for istribution after July 1, 1987.

S OF ENG., SW DIVISION LAB ID # 8602

JEFFERY TYE TEL. (316) 767-2411
1815 CASS STREET
ALLAS TX 75235

The following parameters are certified from 1-1-87 to 12-31-87

ardness	Dis. Solids	Spec. Conductance	Ammonia-Nitrogen
Nitrate-Nitrogen	Tot. Phosphorus	pH	Aluminum
Arsenic	Barium	Cadmium	Calcium
hromium	Copper	Iron	Lead
agnesium	Manganese	Nickel	Potassium
Selenium	Sodium		

The following parameters are certified from 1-1-87 to 6-30-87

Chloride	Mercury	Zinc

imony (Sb), Beryllium (Be), Cyanide, Oil and Grease, Silver (Ag), hallium (Tl), TOC,

his commercial/contract laboratory may provide analytical services to the permittees of OWRB or EPA.

Element: As Matrix: _____

_____

HGA-500 Program Location: _____ L'vov Platform

Instrumental Parameters

Inst. Model : _____

Wavelength : 193.7

Spectral Bandwidth: _____

Light Source : EDL

Current/Watts : 8

Background Correction? Z

Readout Parameters

Absorbance/Conc: _____

☐ Peak Height; time _____

☒ Peak Area; time 5 sec

☐ Recorder: _____

HGA Parameters

HGA Model : 500

Graphite Tube : Pyro

Sample Aliquot: 20 ml .1% nickel nitrate

Sample Introduction

Manual: _____

Automated: X

Replicates: 2

Purge Gas : Ar

Alternate Gas : Nxlr

Keyboard Entries

Step	1	2	3	4	5	6	7	8	9
Temp °C	160	1500	2500	2600	20				
Ramp (s)	1	1	0	1	1				
Hold (s)	75	45	5	6	20				
Read			X						
Rec.			-3						
Baseline									
Int.Flow ml/min			0						
Int.Alt. ml/min									
Ext.Alt. ml/min									

Shorter dry time up .4% Nickel Nitrate (5 ml)

Element: Pb Matrix: _____

HGA-500 Program Location: 6'VOV Platform

Instrumental Parameters

Inst. Model : 5000
Wavelength : 283.3
Spectral Bandwidth: H 0.7
Light Source : EDL
Current/Watts : 10
Background Correction? Zeeman
Energy = 50

Readout Parameters

Absorbance/Conc: Conc
[X] Peak Height; time 6 S
[ ] Peak Area; time _____
[ ] Recorder: _____

HGA Parameters

HGA Model : 500
Graphite Tube Pyro
Sample Aliquot: 10 ml
Sample Introduction
Manual: _____
Automated: X
Replicates: _____
Purge Gas : Ar
Alternate Gas : _____
Alt vol: 10 ml
10% NH_4Cl
2.5% Na Cl 0.2% HNO_3

Keyboard Entries

Step	1	2	3	4	5	6	7	8	9
Temp °C	150	200	600	2100	20	2700	20		
Ramp (s)	30	10	10	1	1	1	1		
Hold (s)	20	20	20	4	5	3	10		
Read				X					
Rec.				-5					
Baseline									
Int.Flow ml/min				0					
Int.Alt. ml/min									
Ext.Alt. ml/min									

[illegible] ONS DATA SHEET

Element: Se Matrix: _____

_____

HGA-500 Program Location: _____ Liver Platform

Instrumental Parameters

Inst. Model : _____

Wavelength : 196.0

Spectral Bandwidth: 2.0

Light Source : EDL

Current/Watts : 6

Background Correction? _____

Readout Parameters

Absorbance/Conc: _____

☐ Peak Height; time _____

☒ Peak Area; time 5 sec

☐ Recorder: _____

_____

_____

HGA Parameters

HGA Model : _____

Graphite Tube : Pyro

Sample Aliquot: 20 ml

20 ml 1% nickel nitrate

Sample Introduction

Manual: _____

Automated: X

Replicates: _____

Purge Gas : Ar

Alternate Gas : _____

Keyboard Entries

Step	1	2	3	4	5	6	7	8	9
Temp °C	160	900	2000	2600	20				
Ramp (s)	1	1	0	1	1				
Hold (s)	75	45	5	6	20				
Read			X						
Rec.			-3						
Baseline									
Int.Flow ml/min			0						
Int.Alt. ml/min									
Ext.Alt. ml/min									

Cal Optical Pyrometer @ 2000

(element or parameter)

Lab No.	First Sample Value (D1)	Second Sample Value (D2)	Relative Percent Differences (RPD)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

$RPD = |D1 - D2| / ((D1 + D2)/2) * 100$

Acceptable Range: 0% - 20%

(element or parameter)

Lab No.	Sample Result (SR)	Spiked Sample Result (SSR)	Spike Added (SA)	Percent Recovery
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

% Recovery = (SSR-SR)/SA * 100

Acceptable Range: 75% - 125%

[illegible].P.A. TEMPERATURE CHECK

DATE	TEMPERATURE	DATE	TEMPERATURE

Procedures for Cleaning Glassware

A. For Trace Metals Analysis

1. Prior to use, glassware for metals analysis should be rinsed with 1:1 AR grade nitric acid followed by millpore water.

2. After use, glassware should be rinsed out with tap water followed by a thorough washing using a prepared Liqui-Nox solution (or similar labware cleaning liquid). The soap solution should be completely rinsed out with tap water and the glassware should be given a final rinse with distilled/dionized water.

3. Glassware which is particularly difficult to clean may clean up using a chromic acid solution. This solution is prepared by adding one bottle of Chromerge to one liter of concentrated sulfuric acid. Extreme caution should be observed when using this solution. The glassware should finally be rinsed with tap water, then distilled dionized water.

4. Immediately after glassware has dried, it should be stored in drawers upside down so as to minimize contamination.

B. For Organic Analysis

1. Prior to use, all glassware to be used in organic analysis should be rinsed with pesticide grade hexane.

2. After glassware has been used, it should be rinsed with tap water followed by fifteen minutes of sonication in a sonication bath filled with a prepared Liqui-Nox soap solution. This should be followed with rinses with tap water, distilled water and pesticed grade acetone. After glassware is completely dried, it should be muffled at 560 C for four hours.

3. If more vigorous cleaning is necessary, rinse after sonication with chromic acid solution followed by rinses and muffling described above.

4. After glassware has cooled sufficiently to handle, remove from furnace and store in drawers.

Notes:

1. Glassware to be used for phosphate determinations should not be washed with detergents containing phosphates.

2. Glassware for ammonia and Kjeldahl nitrogen should be rinsed with ammonia free water.

3. Attached is glassware cleaning information from Handbook for Analytical Quality Control in Water and Wastewater Laboratories, EPA; 1972.

In addition to the "A" marking found on calibrated glassware and the temperature at which the calibration was made, other markings also appear. These include the type of glass, such as Pyrex, Corex, Kimax, etc., the stock number of the particular item, and the capacity of the vessel. If the vessel contains a ground-glass connection, this will also be included along with the TD or TC symbol. An example of the markings usually found on volumetric ware is shown in Figure 4-2.

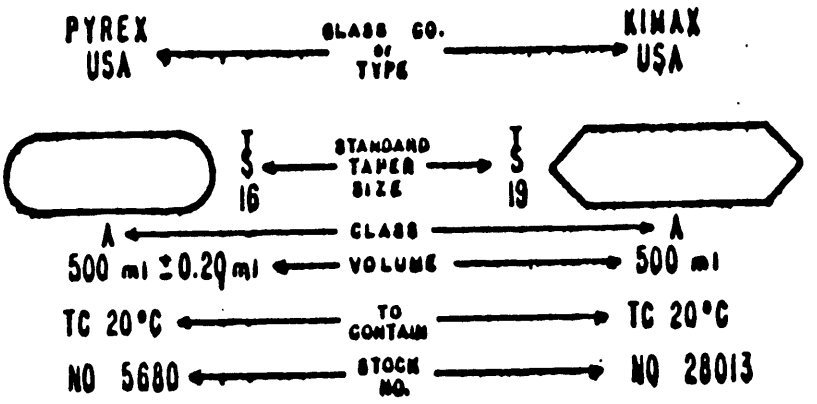


Figure 4-2. EXAMPLE OF MARKINGS ON GLASSWARE

Class A glassware need not be recalibrated before use. However, if it should become necessary to calibrate a particular piece of glassware, directions may be found in texts (2) on quantitative analysis.

4.5 Cleaning of Glass and Porcelain

The method of cleaning should be adapted to both the substances that are to be removed, and the determination to be performed. Water-soluble substances are simply washed out with hot or cold water, and the vessel is finally rinsed with successive small amounts of distilled water. Other substances more difficult to remove may require the use of a detergent, organic solvent, dichromate cleaning solution, nitric acid or aqua regia (25 percent v/v conc. HNO_3 in conc. HCl). In all cases it is good practice to rinse a vessel with tap water as soon as possible after use. Material allowed to dry on glassware is much more difficult to remove.

Volumetric glassware, especially burets, may be thoroughly cleaned by a mixture containing the following: 30 g sodium hydroxide, 4 g sodium hexametaphosphate (trade name, Calgon), 8 g trisodium phosphate, and 1 liter water. A gram or two of sodium lauryl sulfate or other surfactant will improve its action in some cases. This solution should be used with a buret brush.

Dichromate cleaning solution (chromic acid) is a powerful cleaning agent; however, due to its destructive nature upon clothing and upon laboratory furniture, extreme care must be taken when using this mixture. If any of the solution is spilled, it must be cleaned up

immediately. Chromic acid solution may be prepared in the laboratory by adding 1 liter of concentrated sulfuric acid slowly, with stirring, to 35 ml saturated sodium dichromate solution. This mixture must be allowed to stand for approximately 15 minutes in the vessel which is being cleaned and may then be returned to a storage bottle. Following the chromic-acid wash, the vessels are rinsed thoroughly with tap water, then with small successive portions of distilled water. Fuming nitric acid acts more rapidly, but is disagreeable to handle. In either case, when the acid becomes dilute, the cleaning mixture is no longer effective. A mixture of concentrated sulfuric and fuming nitric acids is even more efficient but is also hazardous to use. A persistent greasy layer or spot may be removed by acetone or by allowing a warm solution of sodium hydroxide, about 1 g per 50 ml of water, to stand in the vessel for 10-15 minutes; after rinsing with water, dilute hydrochloric acid, and water again, the vessel is usually clean. Alcoholic potassium hydroxide is also effective in removing grease. To dry glass apparatus, rinse with acetone and blow or draw air through it.

4.6 Special Cleaning Requirements

Absorption cells, used in spectrophotometers, should be kept scrupulously clean, free of scratches, fingerprints, smudges and evaporated film residues. The cells may be cleaned with detergent solutions for removal of organic residues, but should not be soaked for prolonged periods in caustic solutions because of the possibility of etching. Organic solvents may be used to rinse cells in which organic materials have been used. Nitric acid rinses are permissible, but dichromate solutions are not recommended because of the adsorptive properties of dichromate on glass. Rinsing and drying of cells with alcohol or acetone before storage is a preferred practice. Matched cells should be checked to see that they are equivalent by placing portions of the same solution in both cells and taking several readings of the transmittance (%T) or optical density (OD) values. If a cell is mismatched it should be discarded or reserved for rough work.

For certain determinations, especially trace metals, the glassware should also be rinsed with a 1:1 nitric acid-water mixture. This operation is followed by thoroughly rinsing with tap water and successive portions of distilled water. This may require as many as 12-15 rinses, especially if chromium is being determined. The nitric acid rinse is also especially important if lead is being determined.

Glassware to be used for phosphate determinations should not be washed with detergents containing phosphates. This glassware must be thoroughly rinsed with tap water and distilled water. For ammonia and Kjeldahl nitrogen, the glassware must be rinsed with ammonia-free water (See Chapter 2).

Glassware to be used in the determination of trace organic constituents in water, such as chlorinated pesticides, should be as free as possible of organic contaminants. A chromic acid wash of at least 15 minutes is necessary to destroy these organic residues. Rinse thoroughly with tap water, and finally with distilled water. Glassware may be dried for immediate use by rinsing with redistilled acetone. Otherwise glassware may be oven dried or drip dried. Glassware should be stored immediately after drying to prevent any accumulation of dust. Store inverted or with mouth of glassware covered with foil.

Bottles to be used for the collection of samples for organic analyses should be rinsed successively with chromic acid cleaning solution, tap water, distilled water, and finally several times with redistilled solvent (e.g., acetone, hexane, petroleum ether, chloroform).

Caps are washed with detergent, rinsed with tap water, distilled water and solvent. Caps are treated in the same way as the bottles and are stored in a sealed container.

4.7 Disposable Glassware

When the risk of washing a pipet for reuse becomes too great, as in the case of use with toxic materials, or when the cost of washing glassware becomes prohibitive, disposable pipets may be the answer, provided they meet the necessary specification. Various types are available including bacteriological, serological and micro-dilution pipets. Disposable glassware generally is made of soft glass.

4.8 Specialized Glassware

The use of vessels and glassware fitted with standard-taper, ground-glass, and ball-and-socket joints has increased because of certain advantages such as less leakage and fewer freezeups. Standard-taper, interchangeable ground joints save time and trouble in assembling apparatus. They are precision-ground with tested abrasives to insure an accurate fit and freedom from leakage. Ball and socket joints increase flexibility of operation and eliminate the need for exact alignments of apparatus. Symbols and their meaning as applied to standard joints, stoppers and stopcocks are shown below.

4.8.1. Standard Taper (T)

T is the symbol used to designate interchangeable joints, stoppers and stopcocks, complying with the requirements of Commercial Standard CS-21, published by the National Bureau of Standards. All mating parts are finished to a 1:10 taper.

The size of a particular piece appears after the appropriate symbol. Due primarily to the greater variety of apparatus equipped with T fittings, a number of different types of identifications are used, as follows:

a. For joints—a two-part number, as T 24/40, with 24 being the approximate diameter in mm at the large end of the taper, and 40 the axial length of taper, also in mm.

b. For stopcocks—a single number, as T 2, with 2 mm being the approximate diameter of the hole or holes through the plug.

c. For bottles—a single number, as T 19, with 19 mm being the appropriate diameter at top of neck. However, there are differences in dimensions between the bottle and flask stoppers.

d. For flasks, etc. – a single number, as T 19, with 19 mm being the appropriate diameter of the opening at top of neck.

4.8.2 Spherical Joints (S)

S is the designation for spherical (semi-ball) joints complying with CS-21. The complete designation of a spherical joint also consists of a two-part number, as 12/2, with 12 being the approximate diameter of the ball and 2 the bore of the ball and the socket, also in mm.